The image shows the front cover of a spiral-bound notebook. The cover is a light beige or cream color with a subtle, mottled texture. A silver-colored metal spiral binding is visible along the left edge. The text is centered on the cover in a bold, dark brown, sans-serif font.

SOIL REMEDIATION STANDARDS

INTRODUCTION AND OVERVIEW

SOIL REMEDIATION STANDARDS LEGISLATIVE HISTORY

✓ **P.L. 1993 c.139 (S-1070)**

▶ **“HAZARDOUS SITE DISCHARGE
REMEDATION ACT”**

✓ **P.L. 1997 c.278 (S-39)**

▶ **“BROWNFIELD AND CONTAMINATED SITE
REMEDATION ACT”**

✓ **NEW JERSEY STATUTES ANNOTATED
REFERENCE - NJSA 58:10B-12**

SOIL REMEDIATION STANDARDS LEGISLATIVE REQUIREMENTS

✓ REMEDIATION STANDARDS TO BE RISK BASED

- ▶ STATED RISK MANAGEMENT FACTORS
 - 1×10^{-6} FOR CARCINOGENS
 - HQ = 1 FOR NON-CARCINOGENS
- ▶ GENERALLY ACCEPTED AND PEER REVIEWED SCIENTIFIC EVIDENCE OR METHODOLOGIES
- ▶ REASONABLE ASSUMPTIONS OF EXPOSURE SCENARIOS

SOIL REMEDIATION STANDARDS LEGISLATIVE REQUIREMENTS

✓ REMEDIATION STANDARDS TO BE RISK BASED

- ▶ AVOID THE USE OF REDUNDANT CONSERVATIVE ASSUMPTIONS (MAKE USE OF EXPOSURE ASSESSMENT GUIDANCE DEVELOPED BY USEPA)
- ▶ CONSIDER AND UTILIZE TOXICOLOGICAL INFORMATION FROM THE USEPA IRIS DATABASE (IN THE ABSENCE OF OF OTHER STANDARDS BASED OR DEVELOPED BY DEP AND USEPA)

SOIL REMEDIATION STANDARDS LEGISLATIVE REQUIREMENTS

- ✓ DEVELOPMENT OF RESIDENTIAL AND NON-RESIDENTIAL SOIL REMEDIATION STANDARDS**
- ✓ DEVELOPMENT OF SOIL REMEDIATION STANDARDS THAT ARE PROTECTIVE OF GROUND WATER AND SURFACE WATER**
- ✓ ESTABLISH SOIL REMEDIATION STANDARDS AS NUMERIC OR NARRATIVE STANDARDS**

SOIL REMEDIATION STANDARDS LEGISLATIVE REQUIREMENTS

- ✓ **STANDARDS TO BE CONTAMINANT SPECIFIC
(NO CUMULATIVE EFFECTS OF MORE THAN ONE
CONTAMINANT)**
- ✓ **PROVISION FOR ALTERNATIVE SOIL
REMEDICATION STANDARDS BASED UPON SITE
SPECIFIC FACTORS**

SOIL REMEDIATION STANDARDS LEGISLATIVE REQUIREMENTS

- ✓ UNTIL SOIL REMEDIATION STANDARDS ARE ADOPTED, STANDARDS CAN BE DEVELOPED/APPLIED ON A SITE SPECIFIC BASIS
- ✓ NO ECOLOGICAL BASED STANDARDS CAN BE PROPOSED OR ADOPTED UNTIL THE ENVIRONMENT ADVISORY TASK FORCE COMPLETES IT WORK.
- ✓ HOWEVER, ECOLOGICAL BASED STANDARDS CAN BE DEVELOPED/APPLIED OF A SITE SPECIFIC BASIS

SOIL REMEDIATION STANDARDS PLANNED DEVELOPMENT ACTIVITY

- ✓ INTERESTED PARTY REVIEW - INTERNAL**
- ✓ INTERESTED PARTY REVIEW - EXTERNAL**
- ✓ DEVELOPMENT OF RULE TEXT**
- ✓ FORMAL RULE PROPOSAL**
- ✓ PUBLIC HEARING/COMMENTS**
- ✓ RESPONSE TO COMMENTS**
- ✓ RULE ADOPTION**

SOIL REMEDIATION STANDARDS CONTAMINANT LIST

✓ LIST OF CONTAMINANTS

- ▶ COMBINATION OF USEPA PRIORITY POLLUTANT LIST AND USEPA CONTRACT LABORATORY TCL/TAL LIST
- ▶ ADDITION OF OTHER CONTAMINANTS OF CONCERN (BASED ON DEP PROGRAM NEEDS)
- ▶ DELETION OF COMPOUNDS/ELEMENTS (BASED ON ANALYTICAL CONCERNS, TOXICOLOGICAL INFORMATION, CONSOLIDATION OF ISOMERS)
- ▶ RESULTS IN 145 CONTAMINANTS

SOIL REMEDIATION STANDARDS TOXICITY FACTOR HIERARCHY

✓ TOXICITY FACTOR SOURCES/HIERARCHY

- ▶ DEP - A-280
- ▶ EPA - IRIS
- ▶ OTHER SOURCES - INCLUDING
 - EPA - HEAST
 - EPA - NCEA
 - DEP - NON A-280
 - CALIFORNIA EPA

SOIL REMEDIATION STANDARDS TREATMENT OF CLASS “C” CONTAMINANTS

✓ EPA WEIGHT OF EVIDENCE CLASSIFICATION SYSTEM FOR CARCINOGENICITY

- ▶ A - HUMAN CARCINOGEN**
- ▶ B - PROBABLE HUMAN CARCINOGEN**
- ▶ C - POSSIBLE HUMAN CARCINOGEN**
- ▶ D - NOT CLASSIFIABLE AS TO HUMAN
CARCINOGENICITY**
- ▶ E - EVIDENCE OF NONCARCINOGENICITY FOR
HUMANS**

SOIL REMEDIATION STANDARDS TREATMENT OF CLASS “C” CONTAMINANTS

USEPA WATER PROGRAMS

- ✓ CONTAMINANT TREATED AS A NONCARCINOGEN AT HQ = 0.1
- ✓ IF NO NONCARCINOGEN TOX DATA AVAILABLE, CONTAMINANT TREATED AS A CARCINOGEN AT 1 X 10⁻⁵ RISK LEVEL

USEPA SUPERFUND PROGRAM

- ✓ CONTAMINANT TREATED AS A CARCINOGEN AT 1 X 10⁻⁶ RISK LEVEL
- ✓ IF NO CARCINOGEN TOX DATA AVAILABLE, CONTAMINANT TREATED AS A NONCARCINOGEN AT HQ = 1

SOIL REMEDIATION STANDARDS TREATMENT OF CLASS “C” CONTAMINANTS

✓ DEP CLASS “C” CONTAMINANT POLICY

- ▶ TREAT CONTAMINANT AS A CARCINOGEN AT A 1 X 10-6 RISK LEVEL (WITH DSRT REVIEW OF TOXICOLOGICAL DATA)**
- ▶ IF NO CARCINOGEN TOXICOLOGICAL DATA ARE AVAILABLE, TREAT CONTAMINANT AS A NONCARCINOGEN AT HQ = 0.1**

SOIL REMEDIATION STANDARDS

REPORTING OF NUMERIC STANDARDS

- ✓ ALL NUMERIC STANDARDS ARE EXPRESSED AS mg/kg (PPM)
- ✓ STANDARDS LESS THAN 10 mg/kg ARE ROUNDED TO 1 SIGNIFICANT FIGURE
- ✓ STANDARDS GREATER THAN OR EQUAL TO 10 mg/kg ARE ROUNDED TO 2 SIGNIFICANT FIGURES
- ✓ A CONVENTIONAL ROUNDING PROTOCOL WAS EMPLOYED.

SOIL REMEDIATION STANDARDS GENERAL ASSUMPTIONS

- ✓ USE OF USEPA MODELS TO THE GREATEST
EXTENT PRACTICABLE**
- ✓ USE OF USEPA “DEFAULT” PARAMETERS
(MAJOR EXCEPTION - USE OF NEW JERSEY
VALUES OVER NATIONAL VALUES)**

SOIL REMEDIATION STANDARDS

DEVELOPMENT OF STANDARDS

✓ LAND USE SCENARIOS

- ▶ RESIDENTIAL
- ▶ NON-RESIDENTIAL (OUTSIDE WORKER)

✓ STANDARDS FOR OTHER NON-RESIDENTIAL SCENARIOS CAN BE DEVELOPED ON A CASE SPECIFIC BASIS

SOIL REMEDIATION STANDARDS

DEVELOPMENT OF STANDARDS

✓ EXPOSURE PATHWAYS

- ▶ INGESTION - DERMAL
- ▶ INHALATION
- ▶ IMPACT TO GROUND WATER
- ▶ ALLERGIC CONTACT DERMATITIS (HEXAVALENT CHROMIUM) (Currently under review by the Chromium Workgroup)

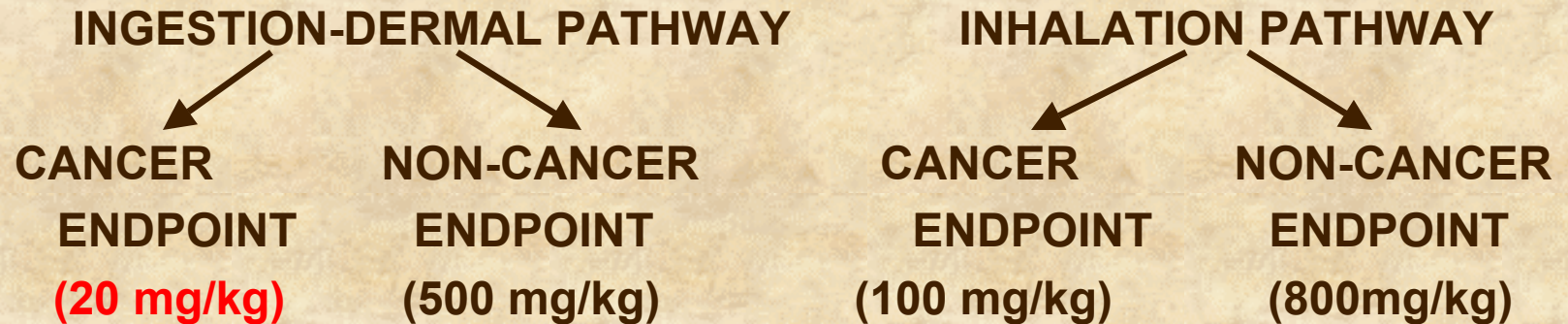
SOIL REMEDIATION STANDARDS

DEVELOPMENT OF STANDARDS

- ✓ **USE THE TOXICITY FACTOR HIERARCHY FOR THE INGESTION-DERMAL AND INHALATION PATHWAYS**
- ✓ **CALCULATE A SOIL REMEDIATION VALUE FOR BOTH CANCER AND NON-CANCER HEALTH ENDPOINTS**
- ✓ **LOWEST DERIVED VALUE BECOMES THE STANDARD FOR THE GIVEN CONTAMINANT**

SOIL REMEDIATION STANDARDS

DEVELOPMENT OF STANDARDS



**SOIL REMEDIATION STANDARD IS THE LOWEST
CALCULATED CONCENTRATION**

SOIL REMEDIATION STANDARDS

PRACTICAL QUANTITATION LEVELS

- ✓ HEALTH BASED CRITERIA MUST BE COMPARED AGAINST ANALYTICAL QUANTITATION LIMITS
- ✓ ANALYTICAL LIMIT USED IS THE PRACTICAL QUANTITATION LEVEL (PQL)
- ✓ PQLs WERE DETERMINED FOR FOR EACH CONTAMINANT WERE TO BE BASED ON THE FOLLOWING:
 - ▶ MULTIPLYING ACTUAL LABORATORY METHOD DETECTION LIMITS (MDLs) OR METHOD ESTIMATED MDLs BY 10 (ORGANICS)
 - ▶ USE OF EPA CLP CONTRACT REQUIRED QUANTITATION LIMITS (METALS)
- ✓ IF HEALTH BASED CONCENTRATION IS LESS THAN THE PQL, THE STANDARD IS SET AT THE PQL

SOIL REMEDIATION STANDARDS

INTERIM SPECIFIC STANDARDS

✓ INTERIM SPECIFIC STANDARDS

- ▶ STANDARDS FOR OTHER CONTAMINANTS CAN BE DEVELOPED ON A CASE SPECIFIC BASIS
- ▶ EXISTING STANDARDS CAN BE MODIFIED BASED ON NEW SCIENTIFIC INFORMATION

SOIL REMEDIATION STANDARDS DEVELOPMENT OF ALTERNATIVE REMEDICATION STANDARDS

- ✓ PROVIDED FOR IN THE BROWNFIELDS ACT
(NJSA 58:10B12f)**
- ✓ THREE LEVELS OR TIERS**
 - ▶ SOIL REMEDIATION STANDARDS USING DEFAULT ASSUMPTIONS**
 - ▶ ALTERNATIVE REMEDIATION STANDARDS USING SITE SPECIFIC VALUES IN LIEU OF DEFAULT ASSUMPTIONS**
 - ▶ ALTERNATIVE REMEDIATION STANDARDS DERIVED FROM USE OF DIFFERENT MODELS**

SOIL REMEDIATION STANDARDS DEVELOPMENT OF ALTERNATIVE REMEDiation STANDARDS

- ✓ BURDEN OF PROOF OF THE PROTECTIVENESS OF THE ARS LIES WITH THE PERSON PROPOSING THE ARS**
- ✓ THE DEPARTMENT CAN DEVELOP / IMPLEMENT AN ARS**
- ✓ AN ARS CAN BE LOWER THAN THE PROMULGATED STANDARD**

SOIL REMEDIATION STANDARDS BACKGROUND

- ✓ **BROWNFIELD ACT PRECLUDES THE DEPARTMENT FROM REQUIRING REMEDIATION BEYOND REGIONAL NATURAL BACKGROUND LEVELS FOR ANY CONTAMINANT (NJSA 58:10B-12g(4))**
- ✓ **BROWNFIELD ACTS REQUIRES THE DEPARTMENT TO DEVELOP REGULATIONS THAT SET FOR A PROCESS TO IDENTIFY BACKGROUND LEVELS.**
 - ▶ **THIS PROCESS IS CONTAINED IN THE TECHNICAL REQUIREMENTS FOR SITE REMEDIATION (NJAC 7:263-3.10)**

SOIL REMEDIATION STANDARDS BACKGROUND

- ✓ IF HEALTH BASED CONCENTRATION IS LESS THAN “BACKGROUND”, THE SITE SPECIFIC STANDARD WILL BE SET AT BACKGROUND

SOIL REMEDIATION STANDARDS BACKGROUND

✓ PROBLEM

▶ WHAT SHOULD BE DONE FOR THOSE CONTAMINANTS WHOSE HEALTH BASED CRITERION IS AT OR BELOW “NATURAL” BACKGROUND LEVELS?

- CONDUCT A SITE SPECIFIC BACKGROUND DETERMINATION
- PROMULGATE A STANDARD BASED ON NATURAL BACKGROUND.

✓ ONLY ONE CONTAMINANT EFFECTED

▶ ARSENIC

SOIL REMEDIATION STANDARDS BACKGROUND

- ✓ **ESTABLISHMENT OF A BACKGROUND VALUE FOR ARSENIC - BALANCING ACT**
- ✓ **NEED TO REDUCE UNNECESSARY BACKGROUND DETERMINATIONS (WORKLOAD ISSUE)**
- ✓ **NEED TO MINIMIZE “FALSE NEGATIVES” (LUMPING DISCHARGES INTO BACKGROUND)**

SOIL REMEDIATION STANDARDS BACKGROUND

✓ DATA SOURCE: SANDERS (2003)

- ▶ DETERMINATION OF BACKGROUND LEVELS OF METALS
- ▶ 248 SAMPLES COLLECTED IN AREAS NOT IMPACTED BY LOCAL DISCHARGES
- ▶ SAMPLES COLLECTED IN THE 4 GEOGRAPHIC REGIONS OF THE STATE
- ▶ SAMPLES COLLECTED IN URBAN AND NONURBAN AREAS

SOIL REMEDIATION STANDARDS BACKGROUND

SANDERS STUDY

Arsenic results - All studies (mg/kg)

<i>Location</i>	<i>Samples</i>	<i>Median</i>	<i>75th percentile</i>	<i>95th percentile</i>	<i>Maximum</i>
<i>Piedmont -Urban</i>	67	5.20	12.40	29.45	49.70
<i>Ridge and Valley - Rural</i>	23	4.90	5.45	7.67	9.90
<i>Highlands - Rural</i>	23	4.80	7.75	9.98	10.30
<i>Coastal Plain - All</i>	135	3.90	7.20	14.49	83.10
<i>Coastal Plain - Urban</i>	91	5.40	9.25	15.35	83.10
<i>Coastal Plain - Rural</i>	44	1.15	2.45	9.14	14.40
<i>All Areas</i>	248	4.70	7.43	18.87	83.10

SOIL REMEDIATION STANDARDS BACKGROUND

- ✓ **SELECTED THE LOWEST REGIONAL 95TH PERCENTILE VALUE AS AN APPROPRIATE VALUE FOR ARSENIC BACKGROUND**
 - ▶ **8 MG/KG**

- ✓ **CONDUCTED A “REALITY CHECK” USING SITE DATA FROM EDSA**
 - ▶ **DATA SET - ALL VALUES \leq 20 MG/KG**
 - ▶ **INCLUDES “CLEAN” AND “DIRTY” SAMPLES**

SOIL REMEDIATION STANDARDS BACKGROUND

ARSENIC VALUES (MG/KG)					
EDSA DATA <=20 MG/KG					
SANDERS STUDY (ALL DATA)					
REGION	n	MEDIAN		75TH PERCENTILE	
Coastal Plain	4718	7.5	3.9	13.5	7.2
Piedmont	6610	3.5	5.2	7.5	12.4
Highlands	414	4.5	4.8	8.5	7.8
Ridge and Valley	259	5.5	4.9	6.5	5.4
All areas	12001	4.5	4.7	8.5	7.4

Ingestion-Dermal Absorption Standards

Linda Cullen

Soil Standards Workshop

August 10, 2004



Compounds Evaluated for Dermal Absorption Pathway

Arsenic
Benzo(a)pyrene
Cadmium
Chlordane
DDT
Lindane
PAHs
Pentachlorophenol
Semi-volatile organic compounds

Combined Ingestion-Dermal Absorption Pathway

- Acknowledges that concurrent exposure occurs via dermal and ingestion pathways
- Consistent with EPA
- Combined pathways employ same target risk as other individual pathways
- Of 145 chemicals, about half have a dermal component and will have lower standards than our current SCC levels

The Nonresidential Scenario Is Changed

- Using EPA's outdoor worker scenario for the nonresidential standards, rather than the indoor worker used in the current Soil Cleanup Criteria
- Outdoor worker scenario is less conservative

Toxicity Information Is Updated

- New toxicity information has been incorporated according to an established hierarchy
- As a result, chemicals with new toxicity data will have different standards than our current Soil Cleanup Criteria levels

Alternative Remediation Standards Are Limited

- Advancements in methodology, such as new toxicity or exposure information, improved or advanced models and methods
- Appropriate site-specific default parameters
- Different land use determinations such as recreational or trespasser scenarios

Compliance With Ingestion-Dermal Standards

- All sampled contaminants that exceed their relevant ingestion-dermal absorption standard must be remediated
- Site wide averaging is **not** routinely accepted, except on a case-by-case basis when sampling is deemed to be representative of the contaminant concentrations across the site

Compliance With Ingestion-Dermal Standards

- Compliance averaging over an area of concern is allowed
- Averaging of sporadic low levels of contaminants with no discernable source area and minimal exceedances of a standard during post excavation sampling are allowed

Impact to Ground Water Standards

Swati Toppin

Soil Standards Workshop

August 10, 2004

Purpose of the Impact to Ground Water Standards

- Protection of ground water from future contamination by chemicals leaching from the soil
- Protection of human health from contaminated ground water ingestion

Why change from the 1992 Soil
Cleanup Criteria methodology?

1992 SCC Methodology

- Semi-volatiles - ranking system
- Volatile organics - Jury model
- Inorganics - develop on site specific basis

Proposed IGW Standards

- Tiered Approach for Standards
 - Generic - for cases/sites with little or no site specific information
 - Alternative Remediation Standards- (IGW ARS) - for cases/sites with some site information

Generic Impact to Ground Water Soil Remediation Standards

Generic standards - based on
conservative simple partitioning
equation in order to apply state-wide
without site specific information.

Generic IGW Soil Remediation Standards Methodology

- 1996 USEPA Soil Screening Level Guidance Document
- Simple Partitioning Equation
- This equation was used to develop the generic Impact to Ground Water Soil Remediation Standards

USEPA Simple Partitioning Equation

- IGWSRS is calculated using the health based GWQC and a dilution attenuation factor
- Receptor well at downgradient edge of AOC. This results in ground water directly under an AOC meeting the GWQC.
- Contaminants in contact with ground water. This results in protection of ground water where there is no buffer zone between the contaminated soil and ground water.

Advantages of Simple Partitioning Equation

- Recommended by USEPA
- Consistent with several other states
- Scientifically defensible
- Protective of ground water users in most cases with little or no site specific information
- Protective of sites with contamination in most mobile form and extending to the water table

Alternative Remediation Standards (ARS)

Brownfields Act authorizes the use of
of Alternative Remediation Standards
based on site specific information

ARS Option A.

Site Specific Adjustment to the Simple Partitioning Equation

- Modification of key parameter values based on site specific data.
- Useful for
 - metals, where pH varies from default assumptions
 - semi-volatiles, where soil organic carbon content is elevated
 - higher dilution attenuation factor possible based on site specific ground water flow data.

ARS Option B.

Immobile Chemicals

- Vadose zone contaminant transport model was used to predict which contaminants would migrate less than 1 foot in 100 years.
- Where a 2 foot clean zone exists between such a contaminant and the ground water, no further remediation is necessary.
- Most useful for:
 - some semi-volatiles,
 - some pesticides,
 - PCBs
 - lead

ARS Option C. Synthetic Precipitation Leaching Procedure (SPLP)

- Uses USEPA Method 1312 to determine the concentration of a contaminant that will leach from the soil.
- Information from this test may be used to derive a site specific IGW ARS

ARS Option C.

Advantages of SPLP

- Uses on-site soil - leaching results are site/AOC specific
- Speciation of metals is a non-issue
- Can be used easily and in early stages of case processing
- Most commonly used and useful for metals, semi-volatiles and pesticides

ARS Option D. SESOIL Modeling

- Used to predict migration of contamination through the vadose zone and the concentration at the water table using site specific data
- This option does not allow future ground water contamination above the GWQC
- Most useful for metals, semi-volatiles, and immobile chemicals if a clean zone exists

ARS Option E. Sesoil/AT123D (Vadose Zone and GW Modeling)

- Data from the SESOIL model is used as source input to ground water transport model (AT123D) to back calculate an acceptable IGW ARS
- Ground water is contaminated and contamination shows a decreasing trend in accordance with Tech Regs for natural GW remediation
- Most useful for volatile organic compounds

ARS Option F. Consideration of Observed Ground Water Conditions

Metals, semi-volatiles and volatiles:

Highest levels of contaminants at water table, yet no ground water impacts observed, no remediation needed

Applicability and Compliance

- Class IIA aquifers
- Single point compliance
- Monitored Natural Attenuation of Soils

Where PHC related contaminants exist above generic levels, and remediation is impracticable, monitor ground water to demonstrate decreasing trends in ground water contamination

Questions?

SCC Semi-Volatile Compounds

- Used Ranking System
- Based on Solubility, Biodegradability and Toxicity for each chemical
- Cleanup Criteria selected based on the sum of the Ranking

SCC Semi-Volatiles

Disadvantages

- May not protect ground water users
- Has no backing from other agencies (ex. USEPA) or scientists
- Not consistent with method used for other compounds

TABLE 1. CATEGORIES OF PARAMETERS USED IN RANKING SYSTEM

CRITERIA	RANKING CATEGORY
Solubility (mg/l)	
<1.0E-2	4
1.0E-2 to 1.0E+2	8
>1.0E+2	12
Biodegradation	
Relatively Undegradable	3
Moderately Degradable	2
Significantly Degradable	1
Toxicity	
A) Carcinogens	
Cancer Slope Factor (mg/kg/day)-1	
<1.0E-1	1
1.0E-1 to 1.0E + 0	2
>1.0E+0	3
B) Noncarcinogens	
Oral RfD (mg/kg/day)	
<1E-4	3
1E-4 to 1E-1	2
>1E-1	1
Total Ranking Sum	Soil Standard (mg/kg)
6-9	500
10-12	100
13-14	50
15-16	10
18	1

Example: Naphthalene

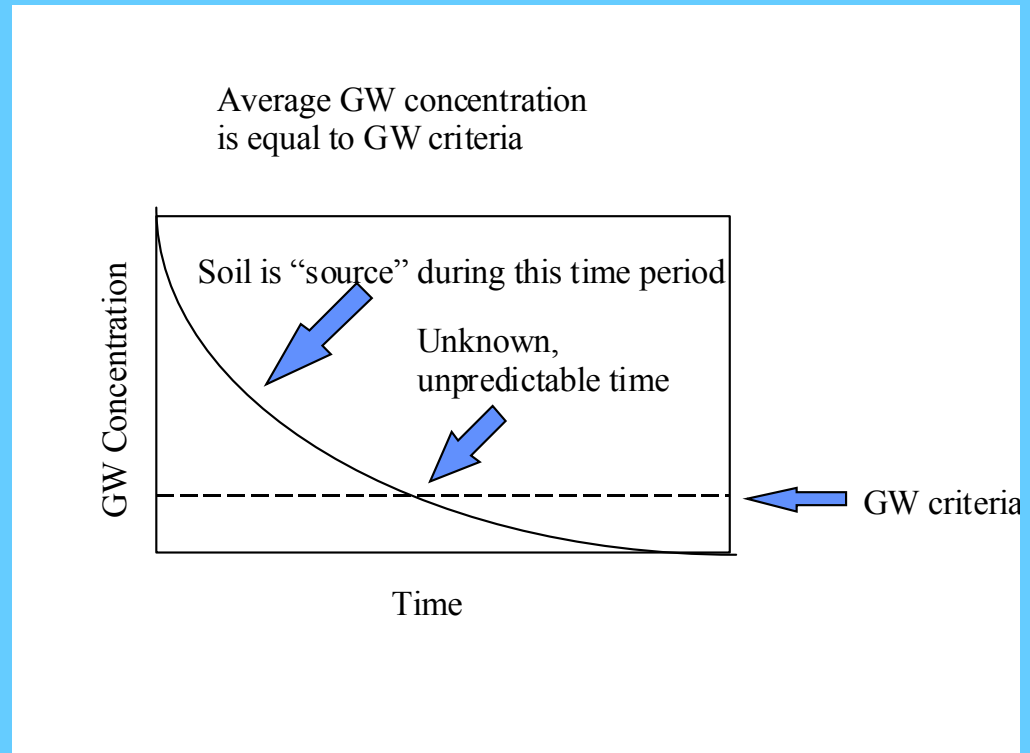
- Solubility = 8
- Biodegradation = 1
- Toxicity = 2
- Sum of Ranks = 11
- IGW SCC= 100 mg/kg

SCC Volatile Organic Compounds

- Jury Model
- The average concentration in ground water met the GWQS over a period 70 years
- A 6 foot thick clean zone was assumed

SCC Volatile Organics Disadvantages

- Not protective of GW users during initial time period
- Not protective of sites with clean zone less than 6 feet thick
- All criteria below 1 ppm were “rounded” to 1 ppm (benzene 0.3 ppm ► 1 ppm)



SCC Inorganic Contaminants

- No criteria were developed
- Footnote states that site specific criteria can be developed

USEPA Simple Partitioning Equation

- Organic Contaminants

$$IGWSCC = C_{gw} \left\{ (K_{oc} f_{oc}) + \frac{\theta_w + \theta_a H'}{\rho_b} \right\} DAF$$

- Inorganic Contaminants

$$IGWSCC = C_{gw} \left\{ (K_d) + \frac{\theta_w + \theta_a H'}{\rho_b} \right\} DAF$$

USEPA Simple Partitioning Assumptions

- receptor well at downgradient edge of AOC
- contaminants in contact with ground water
- contaminants uniformly distributed in AOC
- contaminants extend from surface to water table
- no degradation in AOC

Immobile Chemicals

- Aluminum
- Copper
- Lead
- Vanadium
- Aldrin
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(ghi)perylene
- Benzo(k)fluoranthene
- Bis(2-ethylhexyl phthalate)
- Butyl benzyl phthalate
- di-n-butyl phthalate
- Chlordane
- Chrysene
- DDD
- DDE
- DDT
- Dibenz(a,h)anthracene
- di-n-octyl phthalate
- Fluoranthene
- Heptachlor
- Heptachlor epoxide
- Hexachlorobenzene
- Hexachloro-1,3-butadiene
- Hexachlorocyclopentadiene
- Indeno(1,2,3-cd)pyrene
- Methoxychlor
- PCBs
- Pyrene
- Toxaphene

C. Synthetic Precipitation Leaching Procedure (SPLP)

- Uses USEPA Method 1312 to determine the concentration of a contaminant that will leach from the soil. This leachate concentration is compared to total soil concentration
 - Soil sample is split into two. First sample is analyzed for total contaminant concentration.
 - Remaining sample is subjected to leaching/extraction by liquid with a pH equivalent to acid rain, pH 4.2.
 - Contaminant concentration in leachate is compared to TGWC (GWQC*DAF)
- Results from SPLP test can be used directly by comparing leachate to target ground water concentrations (GWQC * DAF)
- Results may be used to determine site specific K_d which can be used to calculate a site specific IGWARS

Vadose Zone Modeling

(SESOIL)

- Vadose Zone Contaminant Transport Model
- Predicts movement of contaminants in soil prior to their reaching the ground water
- accounts for the contaminant migration processes of advection, volatilization, and degradation
- Precipitation is generated using a statistical formula that incorporates monthly New Jersey climate data.
- The model includes runoff, infiltration, evapotranspiration, and ground water recharge.
- Contaminant transport downward is calculated via advection using a retardation factor.
- Vapor phase transport is also modeled (upward direction only) to allow calculation of contaminant volatilization.

Vadose Zone and GW Modeling

Sesoil/AT123D

- Data from the SESOIL model is used as source input to ground water flow model
- AT123D is an analytical ground water contaminant transport model.
- It accounts for 1) advection 2) dispersion 3) adsorption 4) contaminant decay

Prerequisites for using SESOIL/AT123D Modeling

- ground water is already contaminated
- ground water concentrations at the source will meet GWQS within 5 years
- Source remediation to the calculated ARS will result in a decreasing trend in GW contaminant concentrations
- ground water contamination caused by the IGWARS will not extend beyond the actual ground water plume (which has to be fully delineated)

Inhalation Pathway

Introduction

1. Today's Presentation
2. Initial Task
3. Subcommittee's Deliberations
4. Standard Development and Compliance

Inhalation Pathway

Standard Development

1. Volatiles and Particulates
2. Exposure Scenario Assumptions

Inhalation Pathway

Alternative Remediation Standards

1. Brownfield Act allows site specific inputs
2. Alternative proposals - models

Inhalation Pathway

Compliance

1. Fixed Area and Depth Approach
2. Averaging – 95% UCL of the Mean
3. 95% UCL of the Mean is Compared to Standard

Inhalation Pathway

Optional Compliance

1. Optional Approach
2. Clean and Contaminated Zones
3. Averaging – 95% UCL of the Mean for each Zone
4. Adjusted Average is Compared to Standard

Inhalation Pathway

Critical Parts of the Inhalation Pathway Basis and Background

1. Summary of the Standards,
Table 7 Section V
2. Compliance Protocol,
Appendix J

Inhalation Pathway

Table 7:

Residential

Nonresidential - less than 2 acres

Nonresidential - equal or greater than 2
acres

Inhalation Pathway

Compliance Examples

Assume:

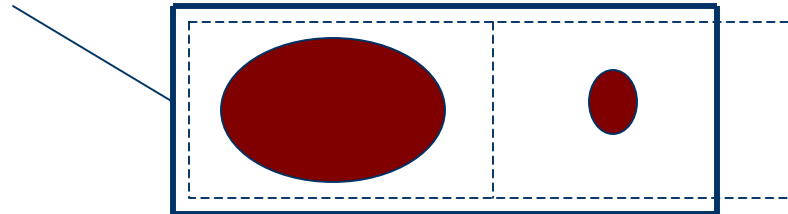
1. Surficial distribution (less than 2 feet in depth) by a particulate contaminant
2. Two nonresidential sites - One is 3.5 acres and the other is 2.5 acres

Inhalation Pathway

Compliance

Site boundary (3.5 acre site)

2 Acre Compliance Layer

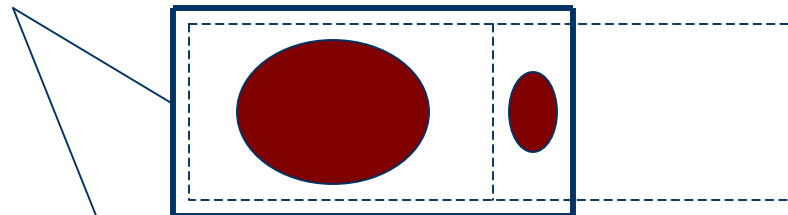


Inhalation Pathway

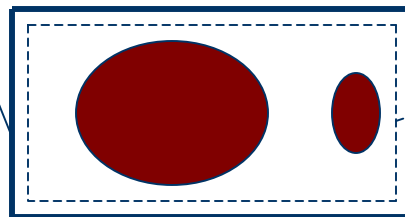
Compliance

Site boundary (2.5 acre site)

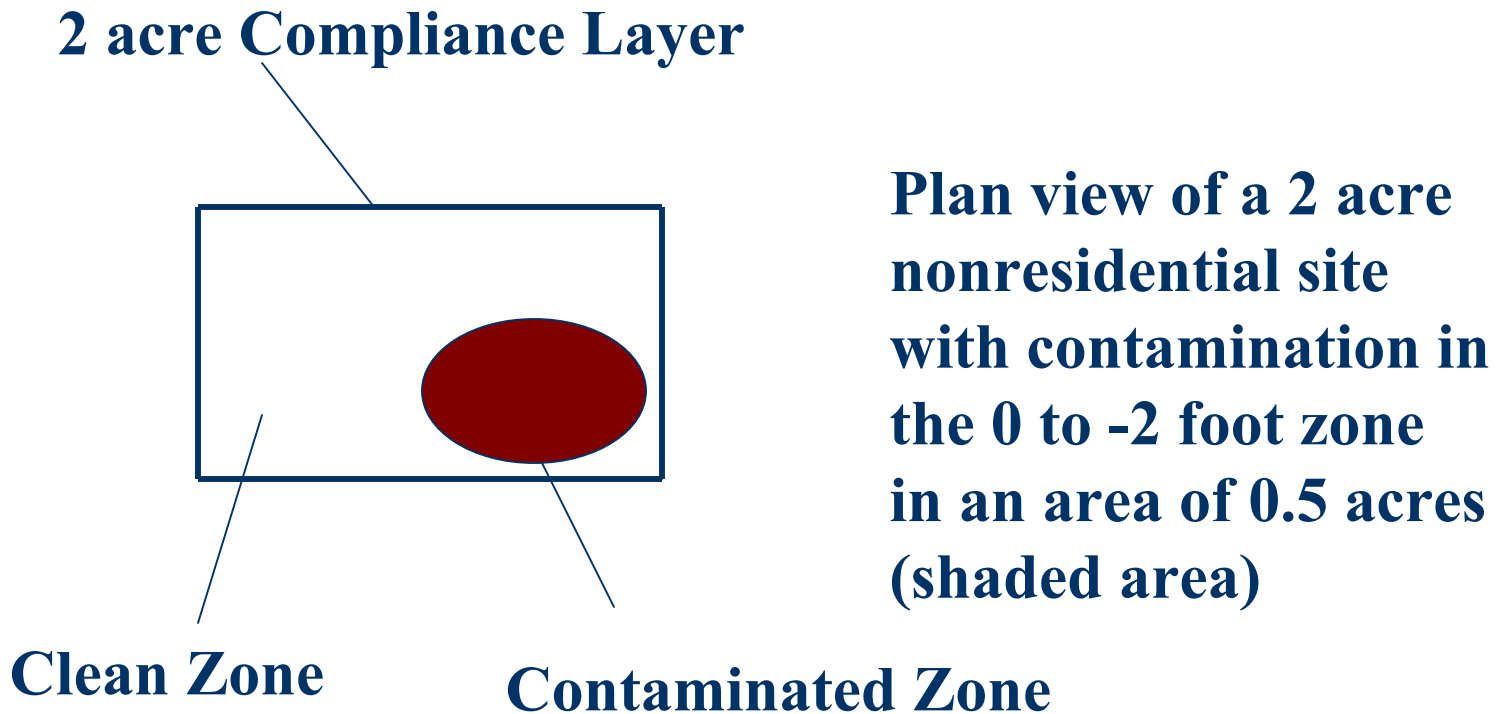
2 acre Compliance Layer



2.5 acre Compliance Layer



Inhalation Pathway



Inhalation Pathway

Assume:

1. A standard of 100 mg/kg
2. The contaminated zone has a 95% UCL of the mean of 200 mg/kg
3. The clean zone has a 95% UCL of the mean of 25 mg/kg

Inhalation Pathway

Then, Within the Compliance Layer:
Contaminated Zone

$$200 \text{ mg/kg} \times 0.5 \text{ acre} = 100 \text{ (mg acre)/(kg)}$$

Clean Zone

$$25 \text{ mg/kg} \times 1.5 \text{ acre} = 37.5 \text{ (mg acre)/(kg)}$$

Inhalation Pathway

**Calculating the Compliance Layer Average
Using the Averages from Both Zones:**

$$\frac{100 \text{ (mg acre)/(kg)} + 37.5 \text{ (mg acre)/(kg)}}{(2 \text{ acre})} =$$

68.75 mg/kg

**Since 68.75 mg/kg is less than 100 mg/kg, there is
no regulatory concern**

Inhalation Pathway

Questions or Constructive Criticism

Terry Sugihara (609) 633-1356

Teruo.Sugihara@dep.state.nj.us



Rulemaking

Soil Standards and Risk Mitigation

Tessie Fields

**Soil Standards Workshop
August 10, 2004**

This presentation will cover

- **Rulemaking basics**
- **How the public is given notice of rules**
- **How the public can comment**
- **What the Department does with public comments**
- **How new rules will fit into the existing site remediation process**



Brownfield Act

Adopt remediation standards that are protective of human health and the environment for:

- **Ground water**
- **Surface water**
- **Soil**

Rulemaking

- **Interested Party Review**
- **Proposal**
- **Adoption**



The Rulemaking Process

Interested Party Review (Optional)

- **Flexible process**
- **Meetings or workshops**
- **No formal response to comments**
- **Input is used to prepare rule proposal**



The Rulemaking Process

Formal Rule Proposal

- **Notification of Proposal**
 - **NJ Register**
 - **Newspapers**
 - **DEP Web Site**
- **30-60 day public comment period**
- **Public hearing (optional)**
- **Written and Oral Comments (paper and diskette)**



The Rulemaking Process

- **Department has 1 year from date of proposal to adopt**
- **Adoption includes**
 - **Summary of comments**
 - **Written responses**
 - **Minor changes upon adoption**
 - **No substantive changes**



Remediation Standards

Water Standards

- **Ground Water Remediation Standards**
(in Tech Rules - NJAC 7:26E-1.13)
 - **Based on Ground Water Quality Standards**
(readoption under development)
- **Surface Water Remediation Standards**
(in Tech Rules - NJAC 7:26E-1.13)
 - **Based on Surface Water Quality Standards**
(readoption under development)



Remediation Standards

Soil Remediation Standards, N.J.A.C. 7:26D

- **New rules under development**
- **Interested Party Review**
- **www.state.nj.us/dep/srp/regs/srs/**



Interested Party Review Draft Soil Remediation Standards

Information on the web site:

- **Introduction**
- **Master table (the numbers)**
- **Basis and background documents:**
 - **Ingestion-dermal exposure pathway**
 - **Inhalation exposure pathway**
 - **Impact to ground water pathway**



Interested Party Review Comments

on or before September 17, 2004

- **e-mail:**
barry.frasco@dep.state.nj.us
- **written (on diskette if possible) :**
Dr. Barry Frasco
NJDEP Hazardous Site Science
PO Box 413
Trenton, New Jersey 08625-0413



How will the new standards work?

**New Soil Standards
Will Work in Concert with
Technical Rules for Site Remediation
(NJAC 7:26E)**



How will the new standards be used?

- **Identify Contaminated Sites**
- **Protect Ground Water**
- **Protect Residential Use (unrestricted)**
- **Protect Non-Residential Use (limited restricted or restricted use)**

Potential Tech Rule Changes

- **Include references to the new standards**
- **New or modified sampling or analytical requirements**
- **New technical guidance (not in rule)**

How will the new standards work?

Types of Remedial Actions

- **Limited Restricted Use**
 - **Deed Notice**
- **Restricted Use**
 - **Engineering Controls and Deed Notice**



Remediation Goals

Remediation = Risk reduction

Risk reduction is to protect human health and the environment

Risk = Contaminant + Receptor + Exposure

Remediation Goals

- **Accomplish risk reduction by:**
 - **Removal of contaminant**
 - **Treatment of contaminant**
 - **Exposure control**
 - **Institutional controls (deed notice)**
 - **Engineering controls (physical barrier)**



Remediation Goals

- **Exposure control**
 - **Institutional controls (deed notice)**
 - **Model in Tech Rules, Appendix E**
 - **Notification**
 - **Limits site use**
 - **Engineering controls (physical barrier)**
 - **Fences**
 - **Caps**
 - **Ground water containment**



Remediation Goals

- **Institutional and engineering control requirements**
 - **Notification**
 - **Monitoring**
 - **Maintenance**
 - **Reporting every 2 years**



Related implementation issues

When to expect the New Standards?

- **No sooner than 1 1/2 years**

Implementation

- **Ongoing cases?**
- **Closed cases?**
- **Use in the interim?**



Questions?